Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

Application of	)	
DIRECTV ENTERPRISES LLC	)	Call Sign:
For Authorization to Launch and Operate DIRECTV 12 at 103° W.L.	)	File No. SAT-LOA-_____

APPLICATION FOR AUTHORIZATION
TO LAUNCH AND OPERATE DIRECTV 12

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APPLICATION FOR AUTHORITY
TO LAUNCH AND OPERATE DIRECTV 12

DIRECTV Enterprises, LLC ("DIRECTV") hereby requests that the Commission authorize the launch and operation of DIRECTV 12, a geostationary Ka-band satellite to be located at the nominal 103° W.L. position, where it will be collocated with, and serve to supplement the existing on-orbit capacity of, the SPACEWAY 1 and DIRECTV 10 satellites. DIRECTV 12 will operate across the Ka-band spectrum licensed to DIRECTV at the 103° W.L. slot. The capabilities of this satellite will be carefully integrated with those of DIRECTV's existing on-orbit Ka-band satellites at the nominal 103° W.L. orbital location in order to optimize the efficient use of valuable spectrum resources at that location and to incorporate redundancy to DIRECTV'S high definition ("HD") programming operations. Grant of this application will promote the HDTV transition, enable DIRECTV to maintain its position as the leader in digital home video entertainment and innovation, and enhance DIRECTV's ability to continue to offer U.S. consumers a powerful alternative to the services of incumbent cable operators.

DIRECTV initially began construction of DIRECTV 12, at its own risk, as a ground spare, but has now determined that the increasing demand for HD carriage – including the Commission's recent adoption of an HD carry one, carry all regime[1] – requires launch of this satellite later this year. Accordingly, DIRECTV requests that the Commission grant this application as expeditiously as possible.

I. GRANT OF THIS APPLICATION WOULD SERVE THE PUBLIC INTEREST

Over the past five years, DIRECTV has demonstrated the suitability of Ka-band spectrum for delivery of high quality multichannel video programming directly to consumers, helping to unlock the enormous potential of this band. With four Ka-band satellites currently providing direct-to-home services,[2] DIRECTV has been able to achieve a quantum leap in the amount of HD digital television programming – including local broadcast stations in HD – available to consumers throughout the country. Nearly 60% of new DIRECTV subscribers, and over 50% of the total DIRECTV customer base, subscribe to HD services. Continuing its tradition as a leader in innovative digital television services, DIRECTV intends not just to ride this wave, but to help accelerate its arrival and augment its impact for American consumers. In this application, DIRECTV seeks authority to launch and operate another vital element in its strategy to maintain its leadership position as an innovator in the digital revolution and to help promote the nation's transition from analog to HD television.

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1 *See Carriage of Digital Television Broadcast Signals: Amendment to Part 76 of the Commission's Rules*, 23 FCC Rcd. 5351 (2008).

2 DIRECTV transmits programming directly to consumers from the DIRECTV 10 and SPACEWAY 1 satellites at the nominal 103° W.L. location and from the DIRECTV 11 and SPACEWAY 2 satellites at the nominal 99° W.L. location. DIRECTV also operates Ka-band payloads on the DIRECTV 8 and DIRECTV 9S satellite at the nominal 101° W.L. location, but those are used for backhaul distribution rather than provision of programming directly to subscribers.

DIRECTV 12 will be used to further expand DIRECTV's capability to provide HD services to American consumers. The satellite is fully compliant with Commission rules relating to Ka-band blanket earth station licensing.[3] Its operations will be carefully integrated with those of DIRECTV's existing on-orbit Ka-band satellites at the nominal 103° W.L. orbital location in order to optimize the efficient use of valuable spectrum resources at that location and to incorporate redundancy to DIRECTV's HD operations. Combined with the SPACEWAY 1 and DIRECTV 10 satellites operating at 103° W.L., this satellite will give DIRECTV the ability to broadcast an additional 80 channels of national HD programming. The satellite will also be capable of supporting 49 spot beams that will serve as in-orbit redundancy or replacement for several operational scenarios.[4] Initially, DIRECTV intends to use this satellite, in part, to take over retransmission of HD local services currently being provided by DIRECTV 10,[5] at which time the spot beam capability of DIRECTV 10 will become the backup for that capability on DIRECTV 12.

By granting this application, the Commission will enable DIRECTV to continue at the forefront of the transition from analog to HD television services, including local HD programming. This capability will allow DIRECTV to maintain its leadership in digital entertainment and innovation and further enhance DIRECTV's ability to compete

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3 *See* 47 U.S.C. §§ 25.138, 25.208.

4 DIRECTV 12 has been designed with the capability of performing the spot beam missions of either DIRECTV 10 at 103° W.L. or DIRECTV 11 at 99° W.L. (should it be repositioned to that orbital location at some time in the future).

5 As the Commission is aware, DIRECTV 10 suffered an anomaly that has limited the capacity available in certain local markets. *See, e.g.,* Letter from William M. Wiltshire to Marlene H. Dortch, CS Docket Nos. 98-120 and 00-96 and MB Docket No. 07-91, at 6 (Mar. 10, 2008); Letter from William M. Wiltshire to Marlene H. Dortch, CS Docket Nos. 98-120 and 00-96 and MB Docket No. 07-91, at 1-2 (Feb. 13, 2008).

with incumbent cable operators to provide the best possible programming service to American consumers.

For the foregoing reasons, DIRECTV respectfully submits that grant of this application would serve the public interest and requests that the Commission act expeditiously so that DIRECTV can proceed to complete construction and launch DIRECTV 12 later this year.

II. INFORMATION REQUIRED UNDER SEC. 25.114 OF THE COMMISSION'S RULES

1. Name, Address, and Telephone Number of Applicant

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3. Type of Authorization Requested

DIRECTV hereby applies for authority to launch and operate DIRECTV 12, a Ka-band satellite that will serve to add up to 80 additional channels of national HD programming to DIRECTV's capabilities and also serve as in-orbit redundancy or replacement for the spot beam payload portion of DIRECTV 10 or DIRECTV 11[6].

4. General Description of Overall System Facilities, Operations, and Services

DIRECTV 12 will consist of a geostationary satellite located at the nominal 103° W.L. orbital location and associated ground station equipment. DIRECTV 12 is designed

[6] Note that DIRECTV 12 is actually a hybrid Ka-band FSS-17/24 GHz BSS satellite. This application relates solely to the Ka-band portion of the satellite. The 17/24 GHz BSS portion of the satellite is being addressed in a separate but interrelated application.

to provide DTH service in the FSS Ka-band (18.3-18.8 GHz and 19.7-20.2 GHz (space-to-earth) and 28.35-28.6 GHz, 29.25-29.5, and 29.5-30.0 GHz (Earth-to-space)). The transfer orbit and on-station Telemetry, Tracking and Control ("TT&C") functions will be provided at the edges of these same frequency bands.

The DIRECTV 12 satellite is capable of supporting sixteen Ka-band transponders (eight LHCP and eight RHCP) providing coverage via a national beam and ten Ka-band transponders (five LHCP and five RHCP) providing coverage via 49 spot beams. The national coverage beam is designed to provide coverage to all 50 states (CONUS, Alaska, and Hawaii) and will carry national HD programming material. The spot beams are designed to serve as in-orbit redundancy or replacement for the spot beam capability of either DIRECTV 10 or DIRECTV 11. All national programming material will be distributed from the DIRECTV broadcast facilities in Los Angeles, CA, and Long Beach, CA, whereas local programming material will be transmitted from the infrastructure used to support such transmissions to either DIRECTV 10 or DIRECTV 11. Using this combination of uplink facilities, the DIRECTV 12 system, operating in concert with DIRECTV's other Ka-band assets, will be capable of transmitting an additional 80 national channels of HD programming.

5. Operational Characteristics

5.1 Frequency and Polarization Plan

Details of the frequency and polarization plan of the DIRECTV 12 satellite, including the TT&C functions, are included in the accompanying Schedule S, which is hereby incorporated by reference as if fully set forth herein. The emission designator for transmission of communications signals in the uplink and downlink will be 36M0G7W. The allocated bandwidth for this emission is 36 MHz. The interconnection capability of

the DIRECTV 12 national coverage and spot transponders is shown in the accompanying Schedule S.

5.2 Communications Payload

5.2.1 Uplink Transmissions

Each of the transponders on DIRECTV 12 is 36 MHz wide and is filtered by the input multiplexers and channel filters. Filtered signals are amplified by individual channel amplifiers with selectable fixed/automatic level control ("ALC") operating modes prior to final amplification in the TWTA. ALC is the normal mode of operation for all channels and this mode has a minimum input dynamic range of 19 dB and a commandable output power range of 15 dB for spot channels, 13 dB for CONUS+Alaska, and 7 dB for Hawaii. The ALC output level can be set using a step size of 0.5 dB. The fixed gain mode of operation has 19 dB of gain step attenuation, settable in approximately 1 dB steps.

The maximum expected G/T performance for DIRECTV 12 for the antennas directed towards the various uplink site locations is shown in the accompanying Schedule S. Note that this G/T value is for beam peak, and the beam pointing will be optimized to place each broadcast site at or near beam peak. Also note that this value of G/T will decrease, dB-for-dB, as the uplink location moves away from beam peak.

The DIRECTV 12 feeder uplink beams will employ receive channel filters to limit the bandwidth of the received signals. A simulated response of a representative input channel filter has been calculated, and Figure 5-1 shows the normalized predicted rejection and insertion loss for such a typical input channel filter.

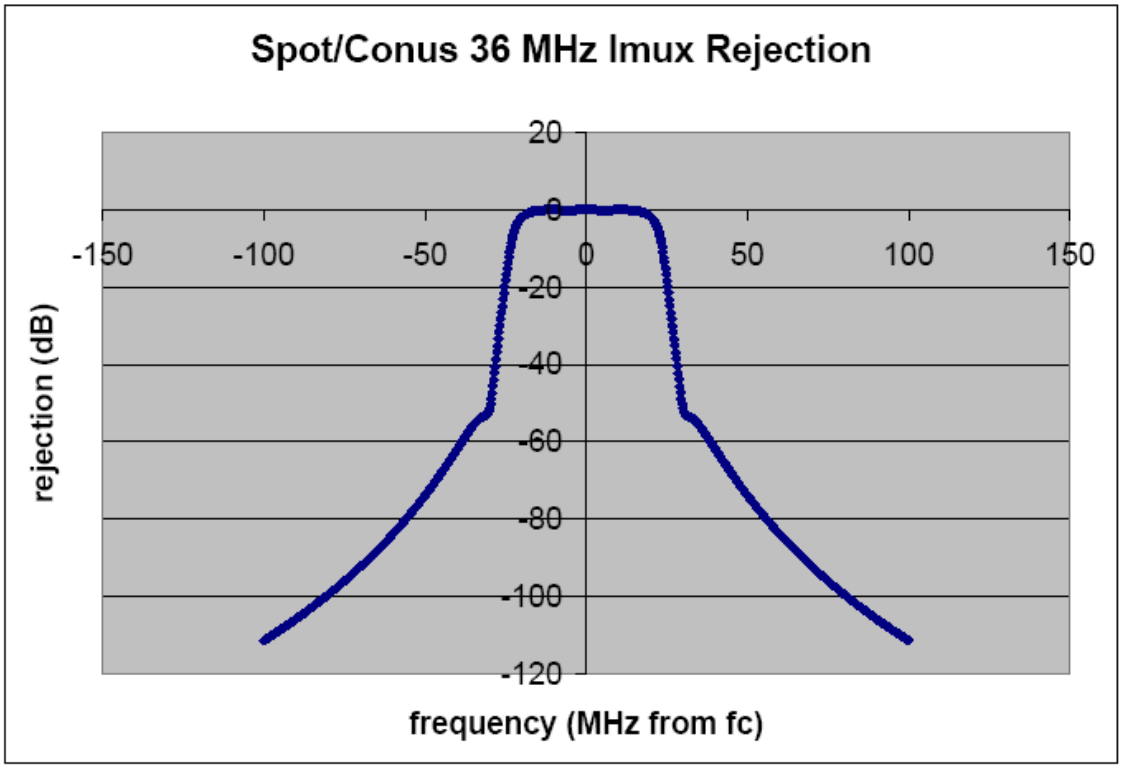

Figure 5-1. Response Characteristic of Typical DIRECTV 12 National and Spot Input Channel Filter

5.2.2 Downlink Transmissions

The national coverage downlink beam uses dual combined output amplifiers ("TWTAs") with a per amplifier output power of 130 Watts (*i.e.*, 260 Watts combined). The spot downlink beams use single amplifier TWTAs with an output power of 70 Watts. The resultant effective transmit power from each of these two types of amplifier assemblies is shown in the accompanying Schedule S.

The output filtering for the national and spot beams is performed by a variety of filters. For the national beam, two different types of filters are used. Each national channel is individually filtered with a 36 MHz channel filter, the simulated response of which is shown as Figure 5-2. In addition, the ensemble of eight adjacent national transponders is filtered with a wideband filter, with a simulated response shown as Figure 5-3.

In light of the assortment of channel combinations supported by the spot beams, a variety of output filters are employed for these beams. The determination of which filter type to use on a particular beam is driven by overall network design considerations. The simulated performance for the output filter types used on the DIRECTV 12 spot beams is shown in Figures 5-2, 5-4, and 5-5. Figure 5-2 illustrates an individual channel filter response, whereas Figures 5-4 and 5-5 show the filter response for an ensemble of output channels.

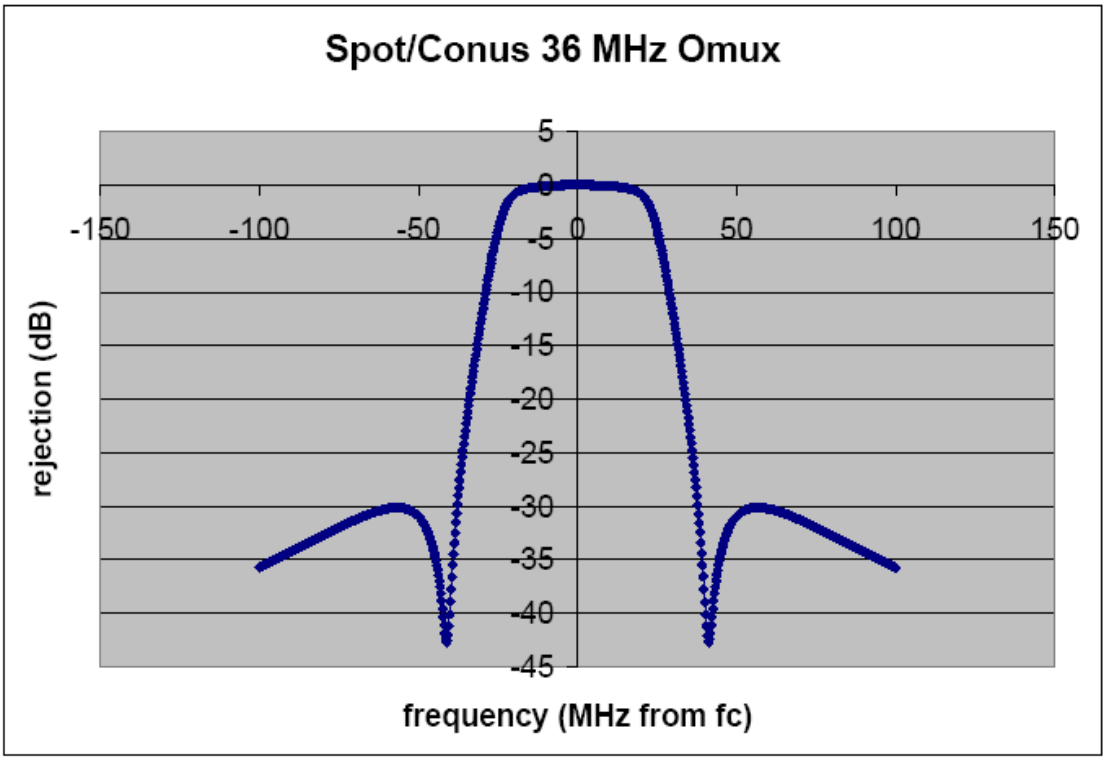

Figure 5-2. Response Characteristic of Typical DIRECTV 12 National and Spot Beam Output Channel Filter

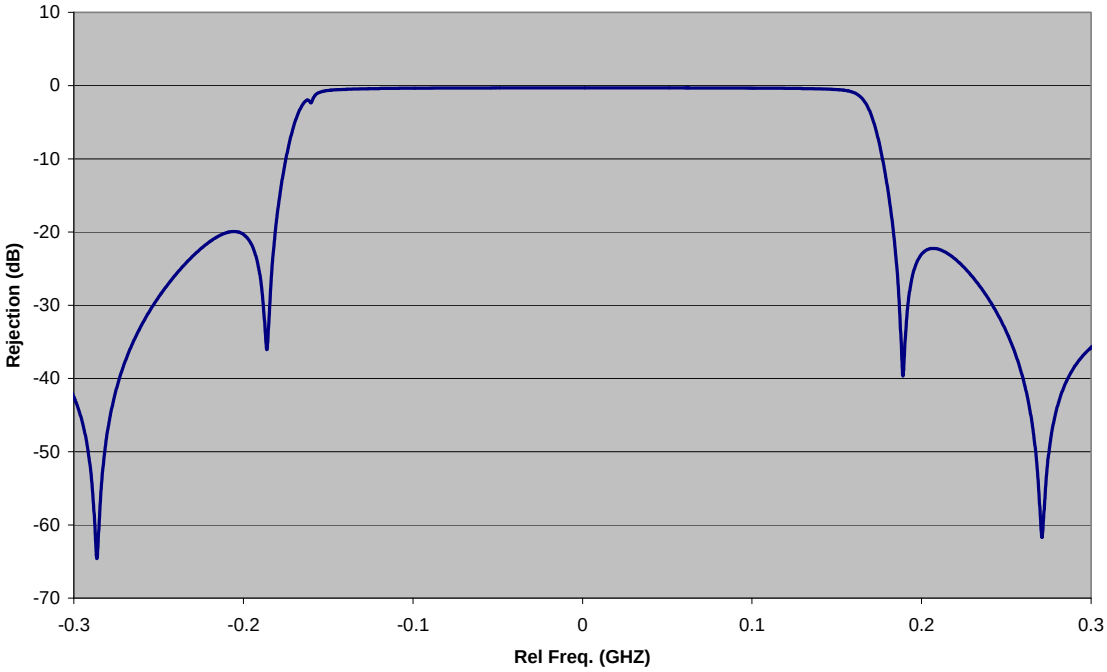

Figure 5-3. Overall Response Characteristic DIRECTV 12 National Beam Output Filter

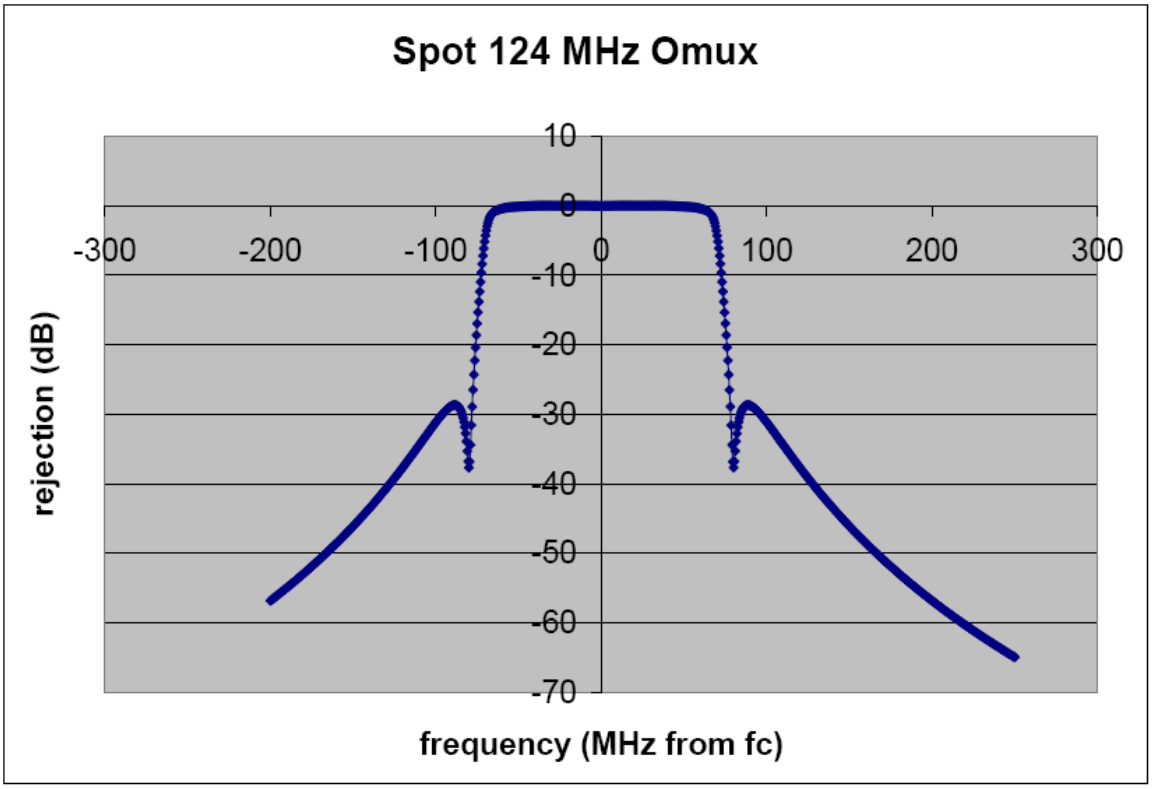

Figure 5-4. DIRECTV 12 Spot Beam 124 MHz Output Filter Response Characteristic

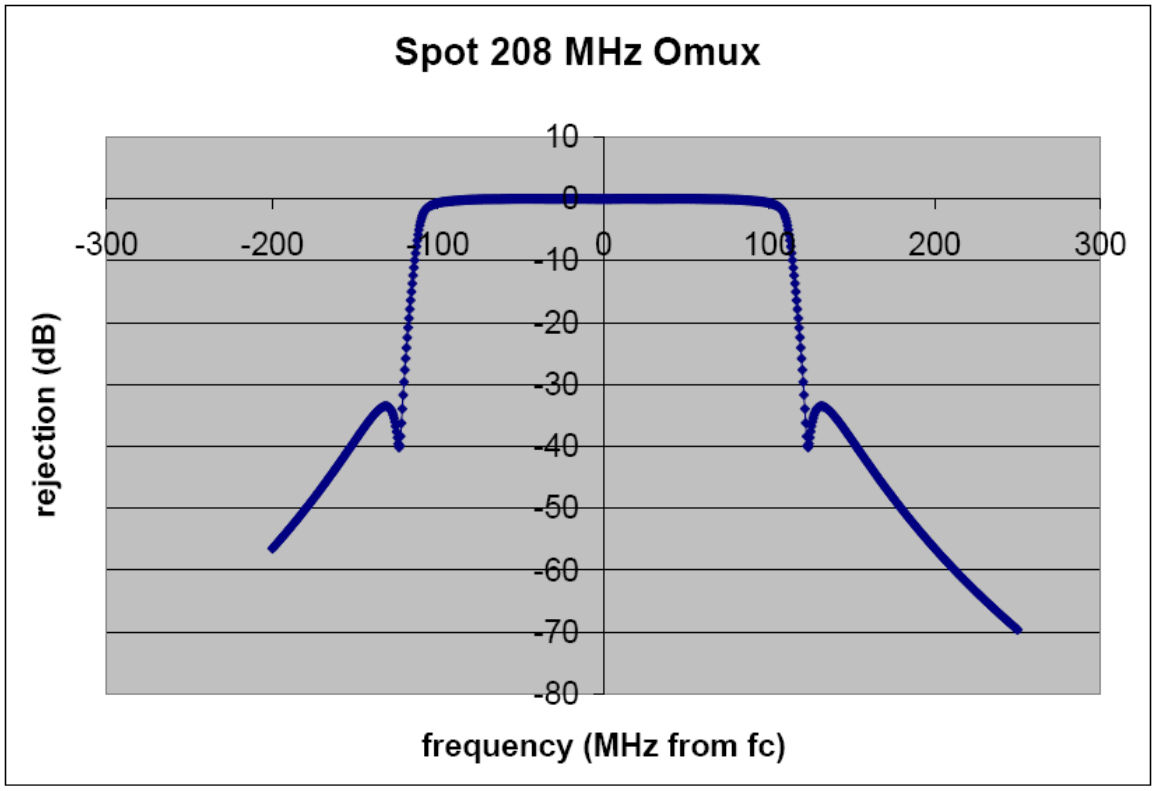

Figure 5-5. DIRECTV 12 Spot Beam 208 MHz Output Filter Response Characteristic

5.3 TT&C Subsystem

The TT&C subsystem provides redundant telemetry, tracking, and command channels for the spacecraft. The principal functions of the subsystem are:

1. Reception and amplification of the radio frequency pointing beacon and command uplinks and demodulation of baseband for subsequent signal processing and command distribution.
2. Modulation, up-conversion, amplification, and transmission of all telemetry data.
3. Reception and retransmission of ground-station-generated ranging signals.

The subsystem is configurable to accommodate the unique requirements of pre-launch, orbit raising, and on-station synchronous orbit operations. The command and telemetry frequencies for DIRECTV 12 are as shown in the accompanying Schedule S.

The minimum cross-polarization isolation for the on-station command and telemetry antennas will be 27 dB.[7]

[7] A request for waiver of the cross-polarization requirements set forth in Section 25.210(i)(1) of the Commission's rules is included with this application.

Note that the telecommand and beacon are transmitted using the same carrier. The beacon is always transmitted, in order to maintain proper pointing of the DIRECTV 12 spot beams. This beacon signal is modulated with tones producing approximately ±80 kHz of frequency modulation. This beacon carrier is also modulated with command data when satellite commands are transmitted to the spacecraft, and this command data modulates the carrier to a width of approximately 1.3 MHz. The emission designators associated with the TT&C subsystem are 1M30F9D for command, 106KG9D for telemetry, and 160KF3N for beacon with associated allocated bandwidths of 1.3 MHz, 106 kHz, and 160 kHz for each of these emissions, respectively.

The telemetry and command link performance is summarized in the link budget analysis in Appendix C. The antenna patterns for the TT&C subsystem are discussed in Section 7.3.

6. Orbital Locations

The DIRECTV 12 satellite will operate in conjunction with the DIRECTV 10 and SPACEWAY 1 satellites at the nominal 103° W.L. orbital location. The precise orbital location will be 102.765° W.L., as is also specified in the accompanying Schedule S.[8] DIRECTV is already authorized to operate over the 18.3-18.8 GHz and 19.7-20.2 GHz (space-to-Earth) and 28.35-28.6 GHz and 29.25-30.0 GHz (Earth-to-space) frequency bands at the nominal 103° W.L. location.

[8] Note that DIRECTV 10 is currently authorized to operate at 102.775° W.L. and SPACEWAY 1 is currently authorized to operate at 102.885° W.L. DIRECTV will be filing requests in the future to slightly modify the orbital locations of these two satellites such that the final configuration of these satellites will be DIRECTV 12 at 102.765° W.L., DIRECTV 10 at 102.815° W.L., and SPACEWAY 1 at 102.925° W.L., with the station keeping of all three satellites maintained to within ±0.025°.

7. Predicted Spacecraft Antenna Gain Contours

7.1 Uplink Beams

The satellite will receive communications signals from the DIRECTV broadcast centers in Los Angeles and Long Beach, CA and from the uplink sites used to feed the spot transponders of DIRECTV 10 and/or DIRECTV 11 using both RHCP and LHCP (*see also* Section 5.1). The GXTs for these uplink beams, while not attached directly to the Schedule S, are provided in a separate GIMS container database file as discussed in the next section. All uplink beams will have a minimum cross-polarization isolation of 27 dB.[9]

7.2 Downlink Beams

The national coverage beam for DIRECTV 12 will cover CONUS, Alaska, and Hawaii using both RHCP and LHCP. The transmit antenna gain contour for the CONUS +Alaska portion of this antenna beam is attached to the accompanying Schedule S. In addition to this national coverage beam, DIRECTV 12 has 49 spot beams that will carry local-into-local HD programming material. The transmit antenna gain contours for each of these 49 spot beams, including the Hawaii spot beam which is part of the national coverage, are being provided in a GIMS container database as described below. All downlink beams will have a minimum cross-polarization isolation of 27 dB.

The antenna gain contours for all beams are provided herewith in GXT format. However, because of the large number of beams involved and the known problems of the Schedule S software in handling this number of beams, the GXT files have not been embedded in the Schedule S software file but are being provided separately to the

[9] A request for waiver of the cross-polarization requirements set forth in Section 25.210(i)(1) of the Commission's rules is included with this application.

Commission in the form of a GIMS container database. (*See also* discussion in Section 5.1.)

7.3 TT&C Beams

During transfer orbit, signals commanding the satellite will be received via a wide angle coverage antenna, capable of supporting command operation in all mission phases including attitude anomalies. The command antenna coverage will be ± 20 degrees about the spacecraft spin axis during transfer orbit and ± 40 degrees about the spacecraft z-axis in both forward and aft directions. A representation of the antenna patterns for these wide area coverage antennas is shown in Appendix B, Figure B-1. Normal on-station command of the satellite will be achieved through the beacon track array and the on-station telemetry will be transmitted via the Ka-band telemetry horn. The coverage pattern for the beacon track array is shown in Appendix B as Figure B-2, and that for the telemetry horn is shown as Figure B-3. On-station contingency command and telemetry of the satellite will be achieved through the wide-angle omni antenna, bicone and pipes as discussed above.

8. Service Description, Link Performance, and Earth Station Parameters

8.1 Service Description

As discussed more fully in Section I of this application, DIRECTV will use the DIRECTV 12 satellite to transmit HD digital video and audio entertainment, and educational and informational programming, including the HD signals of local broadcast stations, to customers throughout the United States who will receive this programming using small dish antennas.

8.2 Link Performance

Representative link budgets are shown in Appendix A as Tables A-1 and A-2 and assume a receive antenna size of 65 cm and also include the interference contribution for adjacent satellite interference from neighboring Ka-band satellites nominally spaced two degrees away. Table A-1 applies to the case of the national coverage beam and Table A-2 to the case of a typical spot beam. Note that an availability of 99.7% has been assumed for both of these budgets.

Representative link budgets for the telemetry and command links are shown in Appendix C as Tables C-1 and C-2, respectively.

8.3 Earth Station Parameters

There are essentially two types of earth stations that will be used with the DIRECTV 12 satellite – feeder-link earth stations and subscriber terminals. The feeder-link stations are relatively large transmit antennas, typically 8 to 9.1 meters, that track the satellite electronically and are used for transmitting national and local-into-local HD programming material from the DIRECTV broadcast sites to the satellite. The subscriber terminals are effectively 65 cm receive antennas that are installed at the customers' premises and have fixed pointing, which is optimized at installation.

9. Satellite Orbit Characteristics

The DIRECTV 12 satellite will be maintained in synchronous orbit at its nominal orbital location with a North-to-South drift tolerance of ± 0.05 degrees and an East-to-West drift tolerance of ± 0.025 degrees. The antenna axis attitude will be maintained so as to keep the beam pointing error to within ± 0.1 degrees.

10. Power Flux Density

The national and spot downlink beams of DIRECTV 12 will be operated so as to generate a maximum downlink EIRP of 58.3 and 59.5 dBW per 36 MHz channel, respectively, and to thereby comply with the Ka-Band blanket licensing coordination threshold of -118 dBW/m^2/MHz. Operation with this EIRP complies with the Commission's requirements as is demonstrated by virtue of the fact that, for a 36 MHz digital carrier, a satellite downlink EIRP of 59.5 dBW results in a maximum PFD of -118 dBW/m^2/MHz on the surface of the Earth (*i.e.*, 59.5 dBW – 162 dBm^2 – 10*log (36) dBMHz). In all cases the upper bound on system and individual link availability is determined by -118 dBW/m^2/MHz, *i.e.* the downlink PFD coordination threshold established in Section 25.138 of the Commission's rules.

The satellite will also comply with the downlink PFD limits established in Section 25.208 of the Commission's rules, which are as follows:

- -115 dB (W/m^2) in any 1 MHz band for angles of arrival between 0 and 5 degrees above the horizontal plane;
- -115 + 0.5 (d-5) dB (W/m^2) in any 1 MHz band for angles of arrival d (in degrees) between 5 and 25 degrees above the horizontal plane; and
- -105 dB (W/m^2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane.

The simple analysis above illustrates that the DIRECTV 12 operations will result in a PFD on the surface of the Earth that is within the Commission's requirements for all angles of arrival.[10]

[10] Based on this demonstration, DIRECTV has not provided the specific PFD information requested in Tab S8 of the Schedule S for each of its 49 spot beams. To the extent necessary, DIRECTV hereby incorporates this showing into its Schedule S by reference.

11. Arrangement for Tracking, Telemetry, and Control

DIRECTV has contracted with Intelsat Satellite Operations to perform the TT&C operations for DIRECTV 12. The Intelsat control center is located in Long Beach, CA. The primary TT&C uplink will come from DIRECTV's Castle Rock Broadcast Center in Castle Rock, CO. The backup TT&C uplink will come from DIRECTV's Northeast Uplink Facility in New Hampton, NH.

12. Physical and Bus Characteristics of the Space Station

The key spacecraft physical and bus characteristics are summarized in the accompanying Schedule S.

13. Common Carrier Status

DIRECTV intends to operate DIRECTV 12 on a non-broadcast, non-common carrier basis. DIRECTV may sell and/or lease a portion of its capacity on a non-common carrier basis for complementary business purposes.

14. Schedule

DIRECTV anticipates that Boeing will complete construction of DIRECTV 12 in October of this year and that the satellite will be launched by the end of this year.

15. Public Interest Considerations

See Section I above.

16. Interference Analysis

The Tables included in Appendix B demonstrate that the DIRECTV 12 satellite design described in this application operates without exceeding the limits set by the Commission's two-degree spacing policy and implementing rules. Accordingly, the proposed DIRECTV 12 satellite will remain in compliance with the relevant technical rules established by the Commission.

At Ka-band, in order to achieve maximum compatibility between diverse networks, the Commission established coordination thresholds for earth station EIRP off-axis levels and spacecraft downlink PFD in the *18 GHz Order*.[11] These operational thresholds are the outcome of the blanket licensing parameters coordinated by industry for Ka-band earth terminals. This DIRECTV 12 proposal is fully compatible with this aspect of the *18 GHz Order*. For U.S. service from 103° WL, the system complies with the established -118 dBW/m^2/MHz PFD threshold, as well as the PFD limitations established in Section 25.208 of the Commission's rules.

The interference studies that are included in this application are performed in conjunction with the end-to-end link performance analyses. Abbreviated link budgets including both uplink and downlink are presented in Appendix A. In each case, the analysis includes the aggregate effects of adjacent satellite interference in evaluating whether the system will operate at acceptable C/(N+I) thresholds.

To properly account for all interference from adjacent operating satellite systems, aggregate interference from earth terminals and satellites associated with pairs of satellites at 2, 4, 6, and 8 degrees of orbit separation were included. The budgets use a level of assumed interference that accounts for the maximum level permissible under the Commission's rules and authorizations. The aggregate adjacent system interference that results from these assumptions is included in the link budget Tables A-1 and A-2. The DIRECTV 12 transmit earth station off-axis EIRP compliance is demonstrated through the following simple calculation:

11 *Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Station in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite Service Use*, 15 FCC Rcd. 13430 (2000) ("18 GHz Order").

Max power into transmit antenna from link budgets = 7.6 dBW

Bandwidth of transmit carrier = 36 MHz

Max power density per 40 kHz into transmit antenna = 7.6 dBW – 10(36E6/40E3) = -21.9 dBW/40 kHz

This value of maximum input power density is well below the -10.63 dBW/40 kHz required to demonstrate compliance with Section 25.138.

17. Orbital Debris Mitigation

DIRECTV has incorporated the material objectives set forth in this application into the technical specifications established for construction of DIRECTV 12.

Spacecraft Hardware Design

DIRECTV has assessed and limited the amount of debris released in a planned manner during normal operations. DIRECTV 12 will not be a source of debris during launch, drift, or operating mode, as DIRECTV does not intend to release debris during the planned course of operations of the satellite.

DIRECTV has also considered the possibility of DIRECTV 12 becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control of the spacecraft and prevent post-mission disposal. As such, DIRECTV has taken steps to address this possibility by incorporating redundancy, shielding, separation of components, and other physical characteristics into the satellite's design. For example, omni-directional antennas have been mounted on opposite sides of the spacecraft, and either will be sufficient to support orbit raising. The command receivers and decoders, telemetry encoders and transmitters, and the bus control electronics are fully redundant, physically separated, and located within a shielded area to minimize the probability of the spacecraft becoming a source of debris due to a collision. DIRECTV will continue to

review these aspects of on-orbit operations with the spacecraft manufacturer and will make adjustments and improvements as appropriate to assure that its spacecraft will not become a source of debris during operations or become derelict in space due to a collision.

Minimizing the Chance of Accidental Explosions

DIRECTV, in direct consultation with Boeing, has assessed and limited, to the maximum extent possible, the probability of accidental explosions during and after completion of mission operations. The key areas reviewed for this purpose have included leakage of propellant and mixing of fuel and oxidizer as well as battery pressure vessels. The basic propulsion design (including component and functional redundancy, and the placement of fuel tanks inside a central cylinder which provides a high level of shielding), propulsion subsystem component construction, preflight verification through both proof testing and analysis, and quality standards have been designed to ensure a very low risk of propellant leakage and fuel and oxidizer mixing that can result in subsequent explosions. During the mission, batteries and various critical areas of the propulsion subsystem will be continually monitored (for both pressure and temperature) to preclude conditions that could result in the remote possibility of explosion and subsequent generation of debris.

After DIRECTV 12 reaches its final disposal orbit, all on-board sources of stored energy will be depleted, all fuel line valves will be left "open," and all batteries will be left in a permanent discharge state. The solar cells will be slewed away from the sun to minimize power generation. As for pressurized vessels, all except four will be depressurized once the satellite has reached end of life. Two of the vessels that retain residual pressure consist of two helium tanks that are used to maintain pressure in the

propellant tanks during the launch of the spacecraft. At the end of the launch phase, standard practice is to seal the tanks and lines permanently so as to prevent fuel and oxidizer from bleeding back into the lines, where they could mix and create the risk of explosion. Boeing estimates that, at the time they are sealed, these tanks will each contain only 200 grams of helium at a pressure of 1600 kPA. DIRECTV has been informed by Boeing that this procedure is used for all Boeing 702 buses and possibly by the entire spacecraft industry. The remaining helium in the two vessels is inert and is at a residual pressure well below the maximum rating of the tanks.

The other two vessels that will maintain a residual pressure at satellite end of life contain the xenon propellant for the XIPS drives. The XIPS drives will be used to maneuver the satellite to its storage orbit after removal from service. The pressure at the thrusters is kept constant by a regulator, and once the pressure in the xenon tank drops below the level of the regulator, gas stops flowing from the tank. At end of life (*i.e.*, once disposal orbit has been achieved), there will remain approximately 2 kg of xenon in each tank at a pressure of 150 kPA. This procedure is standard for all Boeing 702 spacecraft buses using XIPS thrusters for stationkeeping, and is a byproduct of the capability DIRECTV has to ensure compliance with the Commission's post-mission disposal requirements. As with the residual helium, the xenon fuel that remains is inert, and as such there is no risk of chemical energy release.

All four of these tanks with residual pressure are located in the center of the spacecraft, and thus are well shielded and considered to be impervious to collisions with small debris or small meteoroids. The only failure mode that is foreseen as leading to a possible venting of the tanks is a penetration of the bus from a collision with a large, high-energy object, in which case the energy of collision would far surpass the residual

energy from the stored pressure in the vessel. Given the limited pressure remaining in each tank, a sudden release of pressure on its own is not expected to cause fragmentation of the satellite or the ejection of debris.

Accordingly, DIRECTV submits that the standard practice of retaining four tanks with a low residual pressure is a responsible approach and results in a far lower risk of accidental explosion than would any attempt to completely depressurize the tanks during or after the spacecraft's mission. DIRECTV believes that this practice is fully consistent with the intent of Section 25.114(d)(14)(ii) of the Commission's rules, as it will neither pose a risk of accidental explosion nor lead to the ejection of material.

Safe Flight Profiles

DIRECTV has assessed and limited the probability of DIRECTV 12 becoming a source of debris by collisions with large debris or other operational space stations through detailed and conscientious mission planning. DIRECTV has reviewed the list of licensed systems and systems that are under consideration by the Commission for the nominal 103° W.L. orbital location it has requested. In addition, in order to address non-U.S. licensed systems, DIRECTV has reviewed the list of satellite networks in the vicinity of 103° W.L. for which a request for coordination has been submitted to the ITU. Only those networks that are operating, or are planned to be operating, within ± 0.2° have been taken into account in this review.

As a consequence of this review, it has been determined that only three other systems have been licensed by the Commission for, and are currently operating at, the nominal 103° W.L. location: SPACEWAY-1 at 102.885° W.L., DIRECTV 10 at 102.775º W.L., and AMC-1 at 103.0° W.L. Physical coordination of DIRECTV 12 with AMC-1, SPACEWAY-1, and DIRECTV 10 at the nominal 103° W.L. position will be

required. As noted above, the DIRECTV satellites actually operate slightly offset from the 103.0º W.L. position, such that there is no overlap of the station-keeping volumes of these DIRECTV spacecraft with AMC-1 at that position. As for physical coordination with SPACEWAY-1 and DIRECTV 10, DIRECTV will carefully orchestrate orbit maneuvers of these two satellites with those of DIRECTV 12 to ensure that all three satellites are operated safely.

With regard to ITU filings within ±0.2 degrees of 103° W.L., the ITU has published requests for coordination for the following satellite networks:

- Canadian CAN-BSS103.0, CAN-BSS11, and CAN-BSS19 networks at 103°W.L.;
- Luxemburg LUX-G4-58A and LUX-G6-41 at 103° W.L.
- Holland BSSNET2-103W at 103° W.L.

Of these networks, DIRECTV can find evidence of licensing with respect to only one, as Ciel Satellite LP has been granted a license by Canada.[12] However, DIRECTV can find no evidence that satellite construction contracts have been awarded for any of these networks, nor does the most recently available Federal Aviation Administration Commercial Space Station Report show any pending satellite launches for these networks.

Post-Mission Disposal

Consistent with the requirements of Section 25.283(a) of the Commission's rules, at the end of the operational life of the satellite, DIRECTV will maneuver DIRECTV 12 into a disposal orbit with an altitude no less than that calculated using the IADC formula:

$$36{,}021 \text{ km} + (1000 \cdot C_R \cdot A/m)$$

[12] *See generally* information available at http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/en/h_sf08522e.html.

where C_R is the solar pressure radiation coefficient of the spacecraft, and A/m is the Area to mass ratio, in square meters per kilogram, of the spacecraft. The relevant values for the DIRECTV 12 satellite are:

$C_R = 1.152$

$A = 167.6\ m^2$

$m = 3556\ kg$

Inserting these values into the equation yields the following results:

36,021 km + (1000*1.152*(167.6/3556)) = 36075.3 km

Since geostationary altitude is generally considered to be 35,786 km,[13] this yields a desired disposal orbit of at least 289 km above the geostationary arc. DIRECTV intends to boost DIRECTV 12 to at least this height, and in fact will target a height of approximately 300 km above geostationary altitude.

DIRECTV currently intends to allocate and reserve approximately 10 kg of propellant for final orbit raising maneuvers to this altitude. This value was determined through a detailed launch vehicle propellant budget analysis applied to the parameters of one of DIRECTV's most recently designed satellites. In addition, DIRECTV has assessed fuel gauging uncertainty, and this budgeted propellant provides an adequate margin of fuel reserve to ensure that the disposal orbit will be achieved despite such uncertainty.

III. ITU COST RECOVERY

DIRECTV is aware that, as a result of the actions taken at the 1998 Plenipotentiary Conference, as modified by the ITU Council in 2005, processing fees are now charged by the ITU for satellite network filings. As a consequence, Commission

[13] *Mitigation of Orbital Debris*, 19 FCC Rcd. 11567, ¶ 65 (2004).

applicants are responsible for any and all fees charged by the ITU. DIRECTV hereby states that it is aware of this requirement and accepts responsibility to pay any ITU cost recovery fees associated with this application. Invoices for such fees may be sent to the contact representative listed in the accompanying FCC Form 312.

IV. CONCLUSION

In summary, the satellite proposed in this application will provide DIRECTV with a highly capable spacecraft that will support a significant increase in the availability of high-quality HD multichannel video programming for millions of Americans. This new capability will advance the HDTV transition, provide redundancy or replacement for DIRECTV's HD local-into-local operations, and enhance DIRECTV's ability to offer a powerful alternative to incumbent cable operators. Due to the advanced design of the proposed satellite, DIRECTV will be able to provide these benefits without the allocation of any additional spectrum or orbital locations.

For these reasons, DIRECTV submits that the proposed satellite will serve the public interest and respectfully requests that the Commission expeditiously grant this application.

Respectfully submitted,

DIRECTV ENTERPRISES LLC.

By: __\s_____
Romulo Pontual
Executive Vice President and Chief
Technology Officer

ENGINEERING CERTIFICATION

The undersigned hereby certifies to the Federal Communications Commission as follows:

(i) He is the technically qualified person responsible for the engineering information contained in the foregoing Application,

(ii) He is familiar with Part 25 of the Commission's Rules, and

(iii) He has either prepared or reviewed the engineering information contained in the foregoing Application, and it is complete and accurate to the best of his knowledge and belief.

Signed:

/s/

Jack Wengryniuk
Senior Director
DIRECTV Engineering

August 7, 2009

Date

APPENDIX A

DIRECTV 12 LINK BUDGET ANALYSIS

DIRECTV 12 at 102.8W	CONUS - WDC	Clear Sky	Rain Dn
Uplink C/N (thermal), dB	Transmit power, dBW	7.6	13.6
Los Angeles	Transmit losses, dB	-2.0	-2.0
	Ground antenna gain, dB	66.3	66.3
	Antenna pointing loss, dB	-0.5	-0.5
	Free space loss, dB	-213.2	-213.2
	Atmospheric loss, dB	-0.9	-0.9
	Uplink rain loss, dB	0.0	-6.0
	Satellite G/T, dB/K	18.0	18.0
	Bandwidth, dB-Hz	-74.8	-74.8
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Total Uplink C/N		**29.1**	**29.1**
Downlink C/N (thermal),dB	Satellite EIRP, dBW/36 MHz	54.1	54.1
Washington, DC	Free space loss, dB	-209.4	-209.4
	Downlink rain loss, dB	N/A	-4.6
	Total Atmospheric loss, dB	-0.8	-5.6
	Rain temp increase, dB	0.0	-3.4
	Rcv. antenna pointing loss, dB	-1.0	-1.0
	Antenna wetting + noise increase, dB	0.0	-1.0
	Ground G/T, dB/K	18.4	18.4
	Bandwidth, dB-Hz	-74.8	-74.8
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Total Downlink C/N		**15.1**	**5.9**
		Clear Sky	**Rain Dn**
Totals	Uplink C/N (thermal), dB	29.1	29.1
	Downlink C/N (thermal), dB	15.1	5.9
	x-pol interference, dB	19.2	19.2
	Aggregate C/I from ASI	13.0	13.0
	Aggregate C/I from TX E/S	27.8	27.8
	ACI, dB	20.0	20.0
	ABI, dB	99.0	99.0
	Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S)	**11.4**	**11.4**
	Total C/(N+I), dB	**9.8**	**4.8**
Total inter and intra-system C/I, dB	**Required C/(N+I), dB (includes implementation margin)**	**4.7**	**4.7**
	Margin, dB	**5.1**	**0.1**

Table A-1. DIRECTV 12 Link Budget – National Coverage

DIRECTV 12 at 103W	Spot Mode 2	Clear Sky	Rain Dn
Uplink C/N (thermal), dB	Transmit power, dBW	7.6	13.6
Los Angeles	Transmit losses, dB	-2.0	-2.0
	Ground antenna gain, dB	66.3	66.3
	Antenna pointing loss, dB	-0.5	-0.5
	Free space loss, dB	-213.2	-213.2
	Atmospheric loss, dB	-0.9	-0.9
	Uplink rain loss, dB	0.0	-6.0
	Satellite G/T, dB/K	18.0	18.0
	Bandwidth, dB-Hz	-74.8	-74.8
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Total Uplink C/N		**29.1**	**29.1**
Downlink C/N (thermal),dB	Satellite EIRP, dBW/36 MHz	57.5	57.5
Tampa	Free space loss, dB	-209.2	-209.2
	Downlink rain loss, dB	N/A	-6.1
	Total Atmospheric loss, dB	-1.0	-7.3
	Rain temp increase, dB	0.0	-3.7
	Rcv. antenna pointing loss, dB	-1.0	-1.0
	Antenna wetting + noise increase, dB	0.0	-1.0
	Ground G/T, dB/K	18.4	18.4
	Bandwidth, dB-Hz	-74.8	-74.8
	Boltzmann's constant, dBW/Hz K	228.6	228.6
Total Downlink C/N		**18.5**	**7.5**
		Clear Sky	**Rain Dn**
Totals	Uplink C/N (thermal), dB	29.1	29.1
	Downlink C/N (thermal), dB	18.5	7.5
	x-pol interference, dB	19.2	19.2
	Aggregate C/I from ASI	16.3	16.3
	Aggregate C/I from TX E/S	27.8	27.8
	ACI, dB	20.0	20.0
	ABI, dB	14.0	14.0
	Total inter and intra-system C/I, dB (incl. x-pol, ASI, ACI, ABI, TX E/S)	**10.6**	**10.6**
	Total C/(N+I), dB	**9.9**	**5.7**
Total inter and intra-system C/I, dB	**Required C/(N+I), dB (includes implementation margin)**	**3.8**	**3.8**
	Margin, dB	**6.1**	**1.9**

Table A-2. DIRECTV 12 Link Budget – Spot Coverage - Mode 2

APPENDIX B

TT&C Antenna Beam Contours

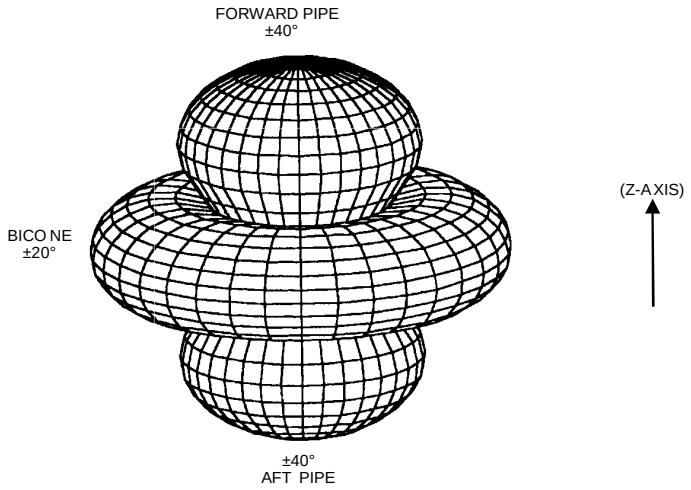

Figure B-1. DIRECTV 12 Wide Beam TT&C Antenna Coverage

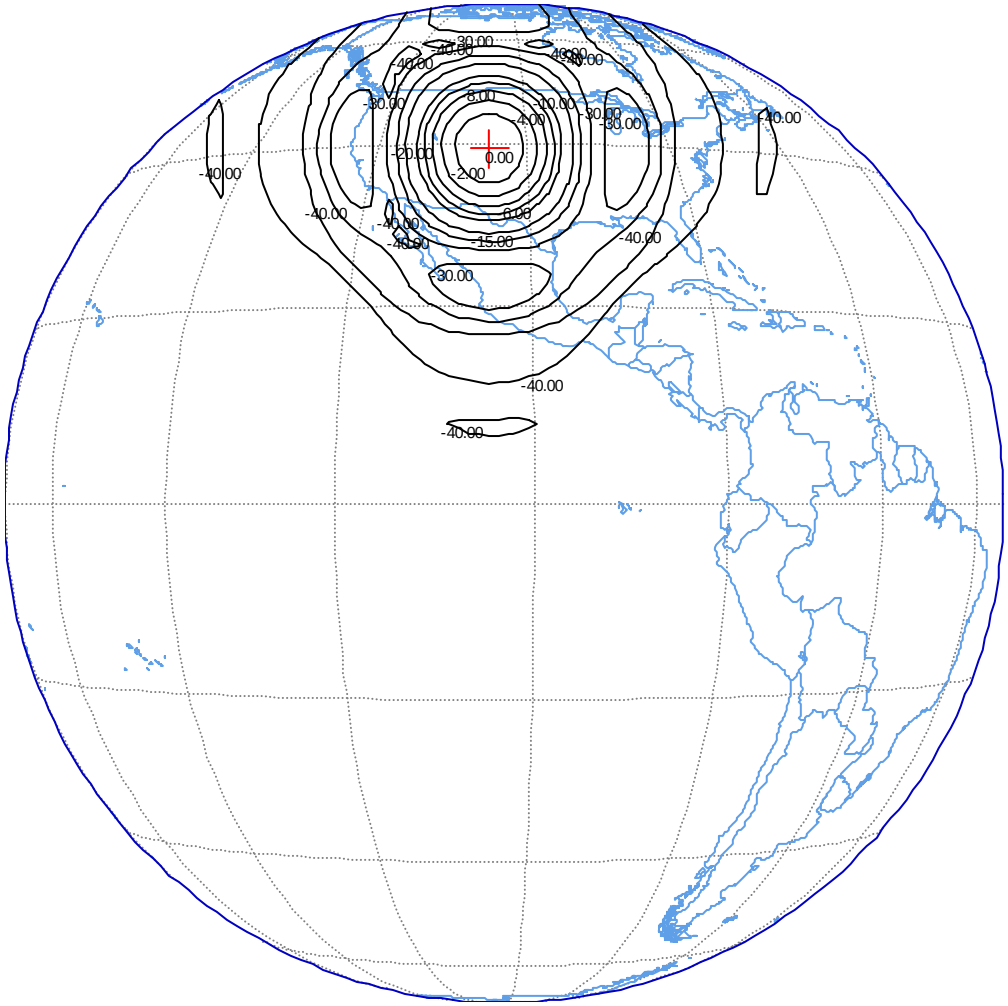

Figure B-2. DIRECTV 12 On-Station Command Antenna Coverage

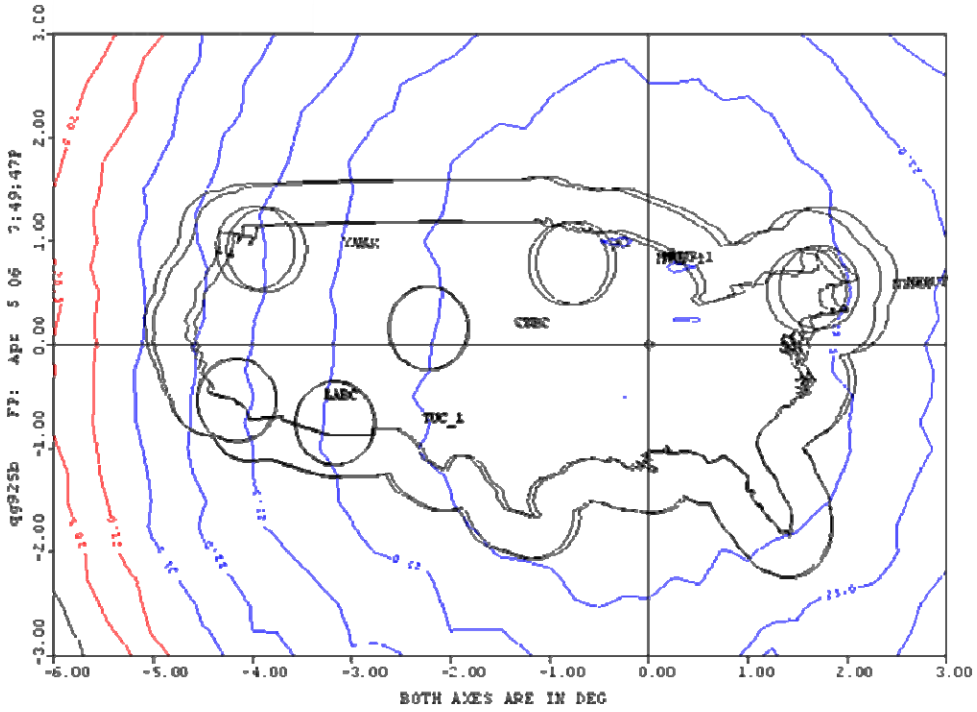

Figure B-3. DIRECTV 12 On-Station Telemetry Horn Antenna Coverage

APPENDIX C

TT&C Link Budgets

TELEMETRY LINK BUDGET (Castle Rock SCF - On Station)

	Units	TM Horn Expected	
SATELLITE PARAMETERS			
Orbit Longitude	deg W	102.8	
Orbit Inclination	deg	0	
Satellite altitude	km	35,787	
Orbit Type		GEO	
Geostationary Altitude	km	35787	
Synchronous Altitude	km	42122	
Specific Altitude	km	42,000	
GROUND PARAMETERS			
Site		Castle Rock Colorado	
Latitude	deg N	39.28	
Longitude	deg E	-104.51	
Altitude	km	2.098	
Frequency	GHz	18.30	
Polarization		Circular	
Elevation Angle	degrees	44.6	
Slant Range	km	37448	
LINK ANALYSIS		Rain	Clear
Availability @ EOC	%	99.70	
Available S/C EIRP	dBW	16.36	16.06
High Power Option	dBW	36.31	35.81
Free Space Loss	dB	-209.16	-209.16
Gaseous Att.	dB	-0.23	-0.10
Scintillation	dB	-0.17	
Cloud Atten	dB	-0.39	
Rain Fade	dB	-1.72	
RIP at GCF antenna	dBW	-193.10	-191.20
High Power	dBW	-176.31	-173.85
SCF PERFORMANCE			
Receive G/T	dB/K	31.00	
Transmit Antenna Axial Ratio	dB	0.99	
Receive Antenna Axial Ratio	dB	1.00	
System Temperature	K	465	
Antenna pointing loss increase	dB	0.05	
PCM Data Rate	kbps	4	
RIP at SCF Antenna	dBW	-193.16	-191.20
Polarization Loss	dB	0.33	0.03
Ground Station G/T	dB/K	31.30	31.00
Pointing Loss	dB	-0.16	-0.16
Rain Temp Increase	dB	-0.31	
Antenna pointing err	dB	-0.35	
Boltzmann's Constant(-1)	dBW/K/Hz	228.60	228.60
Received C/No	dBHz	66.39	66.21
High Power Option	dBHz	67.34	67.78
Required C/No (single mode)	dB-Hz	60.59	60.59
Required C/No (SIMO mode)	dB-Hz	64.20	64.20
Margin* (single mode)	dB	14.81	17.63
Margin* (SIMO mode)	dB	10.32	13.63

Table C-1. On-Station Telemetry Link Budget

COMMAND LINK BUDGET (CO SCF - On Station NORMAL)

	Units	COMMAND	
SATELLITE PARAMETERS			
Orbit Longitude	deg E	-103	
Orbit Inclination	deg	0	
Satellite altitude	km	35,787	
Orbit Type		GEO	
GROUND PARAMETERS			
Site		Castle Rock Colorado	
Latitude	deg N	39.28	
Longitude	deg E	-104.81	
Altitude	km	2.0982	
Rain Rate	mm/hr	34.03	
CCIR Rain Region		E	
Relative Humidity	%	#N/A	
Surface Temp	°C	25	
Frequency	GHz	29.50	
Polarization		C	
Elevation Angle	degrees	44.6	
Slant Range	km	37447	
Polarization Angle	degrees	45	
Transmit Antenna Axial Ratio	Red	0.98	
Receive Antenna Axial Ratio	Red	0.60	
System Temperature	K	67885	
Antenna wetting noise increase	dB	0.05	
LINK ANALYSIS		Rain	Clear
Availability	%	99.70	
SCF EIRP	dBWI	90.00	90.00
Free Space Loss	dB	-213.31	-213.31
Pointing Loss	dB	-0.36	-0.36
Polarization Loss	dB	-0.01	-0.01
Gaseous Att	dB	-0.34	-0.34
Rain Fade	dB	-4.63	
Scintillation	dB	-0.23	
Cloud Atten	dB	-0.23	
Rain Temp Increase	dB	-0.06	
Antenna wetting loss	dB	-0.05	
RIP @ Spacecraft	dBWI	-128.90	-124.02
Required RIP	dBWI	-163.73	-163.73
Margin	dB	24.83	29.71

Table C-2. On-Station Command Link Budget